

# Phillips Scientific

## 16 Channel Discriminator Latch

## CAMAC MODEL 7106

### FEATURES

- 16 Channels in a Single Width CAMAC Module
- 125 MHz Rate Capability < 8 nSec Double Pulse Resolution
- Deadtimeless Updating or Time-Over-Threshold Operation
- Synchronized Operation - Retimed Output Mode
- Internal DATA LATCH captures output states at end of SYNC period
- Common Fast Veto or Individually masked inhibiting
- Local or Remote Modes of Operation
- Linear Summed Output - for Majority Logic Decisions
- Threshold range -10 mV to -1 Volt - CAMAC programmable
- Threshold level readable from CAMAC regardless of Mode
- Test Features allow easy testing of all Channels
- Two Differential ECL Outputs per Channel

### DESCRIPTION

The model 7106 is a high-performance, 16 channel leading edge discriminator packaged in a single width CAMAC module. The most commonly asked for features have been designed into this discriminator, making it an extremely versatile instrument.

The 7106 threshold is variable from -10 mV to -1.033 Volts by either a front panel control when in LOCAL mode, or via CAMAC when in REMOTE mode. The module always powers up in the LOCAL mode which helps eliminate the possibility of having all the thresholds going to minimum, sometimes causing damage to sensitive detectors if the trigger rate were too high. The threshold can be measured at the front panel test point (voltage is ten times threshold) or may be read via CAMAC (10-bit ADC with 1 mV resolution) independent of the MODE of the module.

A linear summed output provides a -1 mA current for each channel that is active. By feeding the SUM output into a discriminator, the user can perform prompt majority logic decisions, selecting events based upon a minimum or maximum number of channels fired, often greatly simplifying the logic required for complex triggers.

Inhibiting of the discriminator can be performed by applying a NIM signal to the VETO input connector, which inhibits all 16 channels simultaneously. Individual channels may be masked (REMOTE mode only) by writing into the internal mask register via CAMAC. The mask register is disabled when-ever the 7106 is in LOCAL mode.

The outputs can be retimed by applying a NIM signal to the SYNC input connector. The state of all channels will be held for the duration of the SYNC input signal. This feature allows the channel profile to be maintained while an event trigger processor captures the profile. In addition to freezing the outputs of the discriminator, the SYNC signal also causes the states of all outputs to be transferred into an internal 16-bit register for subsequent readout via CAMAC. The CAMAC read of the DATA LATCH returns (in addition to 16-bits of data) a Q=1 response, if and only if, a SYNC signal has occurred since the last read of the DATA LATCH. A Q=0 indicates that the DATA LATCH has not been updated since the last CAMAC read.

The 7106 can be used as an updating or Time-Over-Threshold (TOT) discriminator as selected with the front panel Update/TOT switch. The updating output is variable from 4.5 nSec to 110 nSec and will be extended should an input occur while the output is active. In the TOT mode, the output will equal the Time-Over-Threshold of the input or the Preset output duration, whichever is longer. A special TOT mode can be enabled (via internal jumper, one per channel) such that the output duration will equal



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5 nSec or the Time-Over-Threshold of the channel, whichever is longer. A mixture of both types of TOT mode can be used within one module. A front panel LED is on when the UPDATE mode is selected.

Connecting a NIM signal (5 nSec minimum duration) to the TEST input connector will cause those channels not MASKED off to be triggered just as if a normal input signal exceeded the threshold of each channel. A CAMAC command has been included (F25) which when executed will cause all channels not MASKED off to be triggered in the same manner as the TEST input. There is one difference, the CAMAC command (F25) will only execute if the 7106 is in the REMOTE mode. The Q response to the F25 command will indicate whether or not the test pulse was generated. Q=1 means it was. The TEST feature, used in conjunction with the MASK register, allows user defined output patterns to be generated for testing complex triggers.

The front panel switch labeled CAMAC/LOCAL determines which features are programmable. When the switch is in the LOCAL position, CAMAC can only monitor the 7106; i.e., read THRESHOLD voltage and DATA LATCH contents. While in LOCAL the effects of the MASK register and internal Threshold DAC are disabled, but both registers can still be written into and read out. Switching between LOCAL and CAMAC will not alter the contents of any internal register. When the front panel switch is in the CAMAC position, the mode of the 7106 (LOCAL or REMOTE) is programmable via CAMAC. When programmed into the REMOTE mode, the THRESHOLD is controlled by an internal 10-bit DAC, and the MASK register is enabled. CAMAC can also force the 7106 into the LOCAL mode which is identical to positioning the switch to LOCAL with one exception and that is that CAMAC can force the unit back into the REMOTE mode (only if the switch is in CAMAC). A front panel LED is on when the 7106 is in the REMOTE mode.

## INPUT CHARACTERISTICS

### Signal Inputs:

One LEMO style connector per channel; 50 ohms  $\pm 1\%$  direct coupled, reflections  $< \pm 2\%$  for 3nSec risetime. Can withstand transients to  $\pm 100$  Volts (2 amps) for 1  $\mu$ Sec with no damage to the inputs. Clamps at -5.5 Volts and +0.7 Volts. Offset  $< \pm 1$  mV.

### Threshold:

Common threshold for all 16 channels from -10 mV to -1.033 Volts  $\pm 2$  mV or  $\pm 2\%$ , whichever is greater. Adjustable from a 15-turn front panel control when in LOCAL mode or a 10-bit DAC when in REMOTE mode. A front panel test point provides a DC voltage ten times the threshold setting  $\pm 2\%$ . The threshold can also be measured via CAMAC regardless of LOCAL/REMOTE (uses 10-bit ADC, -1 mV/bit). Input hysteresis is typically 4 mV.

### Veto:

One LEMO style connector; Input common to all 16 channels; Accepts a normal NIM level (-500 mV or greater), 50 ohms direct coupled. Inhibits all channels, must precede the input pulse by 3 nSec and overlap the leading edge of the input signal by 2 nSec. Minimum width must be  $> 5$  nSec.

### Sync:

One LEMO style connector; Input common to all 16 channels. Accepts a normal NIM level (-500 mV or greater), 50 ohms direct coupled. Minimum width is 10 nSec. The state of the outputs at the time the SYNC occurs are held for the duration of the SYNC pulse. The output states are transferred to a DATA LATCH at the trailing edge of the SYNC pulse. The SYNC pulse duration must be  $> 40$  nSec if the DATA LATCH feature is used.

### Test Input:

One LEMO style connector; Input common to all 16 channels. Accepts a normal NIM level (-500 mV or greater), 50 ohms direct coupled. Minimum input width is 5 nSec. Threshold must be set to -50 mV or less for Test signal to trigger all un-masked channels.

## OUTPUT CHARACTERISTICS

### Signal Outputs:

Two ECL outputs per channel producing -8 Volts and -1.6 Volts across 100 ohms. Ideal for driving flat twisted pair cables. Output risetimes and falltimes are typically 1.5 nSec.

### Output Duration:

A front panel switch (UPDATE/TOT) allows either Updating or Time-Over-Threshold (TOT) operation common to all 16 channels.

**Updating:** The output width is preset via front panel 15-turn screwdriver adjustment, continuously variable from 4.5 nSec to 110 nSec with a stability of  $\pm .15\%/^{\circ}\text{C}$  of setting. Width uniformity of .5nSec or 5%, whichever is greater.

**TOT:** The normal TOT mode (no internal jumpers) provides an output equal to the duration of the TOT of the input or the preset width, whichever is longer. (The preset width is common to all 16 channels). The special TOT mode (enabled via jumper on a per channel basis) provides an output equal to 5 nSec or the TOT whichever is longer, independent of the preset width setting.

### Sum Output:

One LEMO style connector; Output common to all 16 channels; -1 mA output pulse (-50 mV into 50 ohms) for each channel triggered. Output duration is equal to the output width of the respective channel. Output risetimes and falltimes are less than 3 nSec into 50 ohms. Maximum output before internal clamping takes place is -1.8 volts.

# CAMAC COMMANDS

## **N F(0) A(0):**

Reads back the contents of the MASK register (R1-R16), channel one of the discriminator is associated with bit R1 (Q, X response =1).

## **N F(0) A(1):**

Reads the contents of the internal DATA LATCH (R1-R16). X is always returned =1, but Q=1 only if a SYNC input occurred since the last read DATA LATCH command. (N F(0) A(1) Channel one is associated with bit R1. A bit=1 means the associated channel was active when SYNC pulse occurred.

## **N F(1) A(0):**

Reads back the contents of the internal DAC threshold register (R1-R10). (Q and X response always returned =1). The internal DAC controls the threshold of the unit only when the unit is in the REMOTE mode. The DAC register can be read back independent of the mode of the unit.

## **N F(1) A(1):**

Reads the current threshold level and status (independent of the mode of the 7106), R1-R10, R14-R16, Q and X response always =1.  
R1-R10: ADC reading, -1 mV/bit conversion gain

R14: Reflects the state of the SYNC input at the time the N F(1) A(1) command executes.  
1 = No SYNC present,  
0 = SYNC is present.

R15: 1 = Time-Over-Threshold mode in effect.  
0 = UPDATE mode is in effect.

R16: 1 = LOCAL mode is in effect  
0 = REMOTE mode is in effect

In addition to returning the threshold level and status, another conversion is automatically started at S2 time. The user should wait at least 500  $\mu$ Sec following major DAC threshold changes before reading the threshold with the N F(1) A(1) command. the N F(17) A(1) command can be used to start an ADC cycle.

## **N F(16) A(0):**

Writes into the MASK register (W1-W16), always returns Q and X equal to one. The contents of the MASK register have affect only when the 7106 is in the REMOTE mode of operation. When in REMOTE, writing a zero into a bit position will disable the channel associated with that bit. (Channel one is associated with W1, channel 16 with W16.) The MASK register may be written into and read out independent of the mode of the 7106.

## **N F(17) A(0):**

Writes into the internal Threshold DAC register (W1-W10), always returns Q and X equal to one. The Threshold DAC only controls the threshold level of the unit while the 7106 is in the REMOTE mode of operation. The conversion gain is  $-10 \text{ mV} + 1 \text{ mV/bit}$ , which spans -10 mV to -1.033 Volts. The Threshold DAC register may be written into or read out independent of the mode of operation of the 7106. Allow 1 mSec settling time for DAC changes greater than 10% of full scale.

## **N F(17) A(1):**

Starts a Threshold ADC cycle, always returns Q and X equal to one. The ADC cycle lasts 60  $\mu$ SEC max. Note that the read Threshold command also starts a new conversion at S2 time.

## **N F(24) A(0):**

Clears the internal mode bit at S1 Time. If the front panel control CAMAC/LOCAL is in the CAMAC position then clearing the internal mode bit will force the 7106 into the LOCAL mode of operation. Always returns Q and X equal to one.

## **N F(25) A(0):**

Generates a test input to all channels not MASKED off if the 7106 is in the REMOTE mode of operation. If the unit is in LOCAL, then no test cycle is initiated. X is always returned equal to one, but Q is returned equal to one only if a test cycle was generated.

## **N F(26) A(0):**

Sets the internal mode bit at S1 time. If the front panel control CAMAC/LOCAL is in the CAMAC position then setting the internal mode bit will force the 7106 into the REMOTE mode of operation. If the control is in LOCAL, the unit remains in LOCAL (the internal mode bit is still set, but it does not change the mode of the unit). (Always returns Q and X equal to one.)

## **N F(27) A(0):**

Returns Q=1 if the unit is in REMOTE else Q=0. X is always returned equal to one.

## **Z:**

Upon receipt of the Z at S2 time, the following actions take place.

The internal mode bit is cleared. (insures LOCAL mode is in effect) The MASK register is loaded with all ones. The Threshold DAC is set to -1.033 Volts.

## GENERAL CHARACTERISTICS

### Rate:

125 MHz minimum input to output, typically 140 MHz.

### Double-Pulse Resolution:

Less than 8 nSec; typically 7 nSec with output width set at minimum.

### Time Slewing:

Less than 600 pSec for inputs from two times threshold to 20 times threshold, for 1 nSec input risetimes.

### Input to Output Delay:

Signal input to output less than 11 nSec. Test input to output less than 15 nSec.

### Multiple Pulsing:

None

### Power Supply Requirements (Maximum)

-6 V @ 3.0 Amps      -24 V @ 30 mA

+6 V @ 1.0 Amps      +24 V @ 200 mA

### Operating Temperature:

0°C to 60°C ambient.

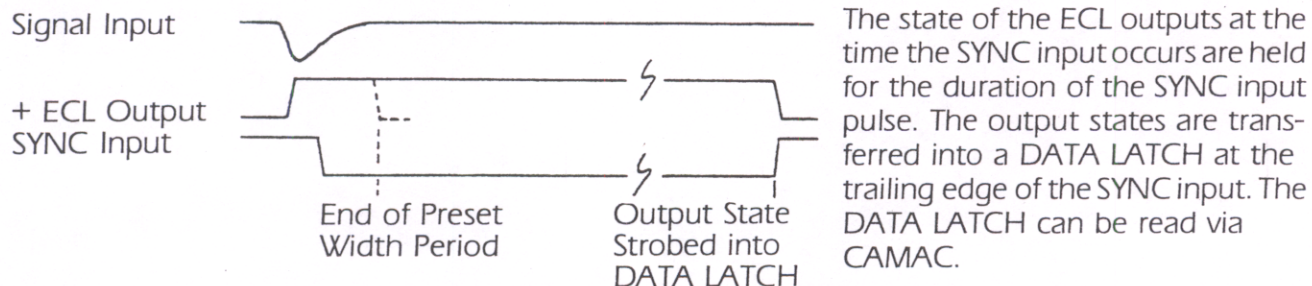
### Packaging:

Standard single width CAMAC module in accordance with ESONE Report EUR 4100.

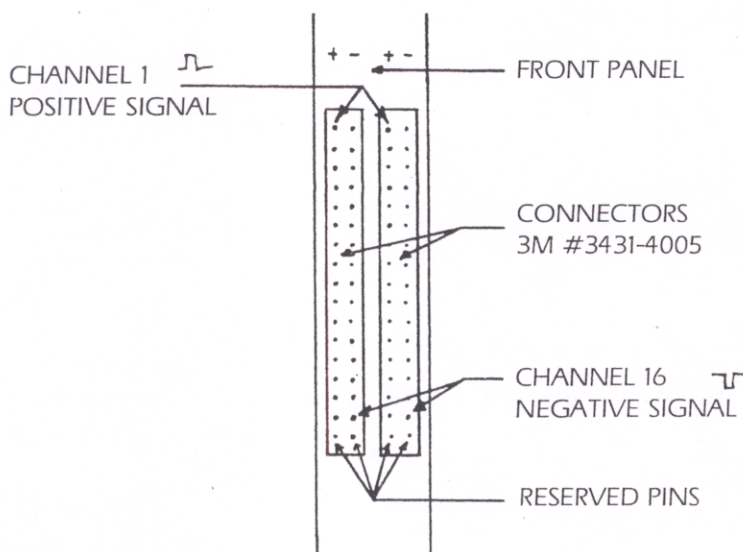
### Quality Control:

Standard 36-hour, cycled burn-in with switched power cycles.

## LATCHED OPERATION



## OUTPUT SIGNAL CONNECTOR



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